

We claim:

1. A water storage apparatus for selectively storing and releasing water delivered from a well via a water pump, the apparatus comprising:

a pressure vessel having an opening and an interior volume;

5 an elastic member inside the pressure vessel and separating the interior volume into a water storing volume and an air storing volume, the water storing volume communicating with the water pump and is filled with water supplied by the pump, the air storing volume containing a fixed amount of air, the volume of the air storing volume decreasing and the pressure increasing in response to water being pumped
10 into the water storing volume, the volume air storing volume increasing and the pressure decreasing in response to a decrease in the amount of water in the water storing volume;

a conduit in the pressure vessel opening and defining an air passage in communication with the air storing volume;

15 an air pressure switch in communication with the air passage and adapted to activate the pump in response to the air pressure in the air storing volume dropping below a first limit and deactivating the pump in response to air pressure rising above a second limit; and

a piercing member contiguous with the conduit and extending into the air storing volume
20 to pierce the elastic member in the event that the elastic member contacts the piercing member due to the air storing volume shrinking below a normal operating range of volumes.

2. The water storage apparatus of claim 1, wherein the air passage extends through the piercing member.

25 3. The water storage apparatus of claim 1, wherein the piercing member has an elongated needle shaped body extending away from the conduit and into the air containing volume.

4. The water storage apparatus of claim 1, wherein the piercing member is integral with the conduit.

5. The water storage apparatus of claim 4, wherein the air passage extends through the piercing member.
6. The water storage apparatus of claim 1, further comprising a seal across the opening and containing the fixed amount of air in the air storing volume, wherein the piercing member
5 pierces the seal as the conduit is coupled to the opening.
7. The water storage apparatus of claim 6, wherein the seal is a resilient seal.
8. The water storage apparatus of claim 6, wherein the seal is frangible.
9. The water storage apparatus of claim 1, further comprising a spud around the opening and a seal across the opening, the conduit having a threaded portion adapted to thread into the
10 spud, the piercing member piercing the seal as the conduit is threaded into the spud.
10. The water storage apparatus of claim 9, wherein the seal is resilient to allow the conduit and piercing member to be removed from the opening without sustaining substantial pressure losses in the air storing volume.
11. The water storage apparatus of claim 1, further comprising an air pressure gauge coupled
15 to the conduit and in communication with the air passage, the air pressure gauge sensing air pressure in the air passage and providing a visual indication of pressure.

12. A water storage apparatus for selectively storing and releasing water delivered from a well via a water pump, the apparatus comprising:

a pressure vessel having an opening and an interior volume;

an elastic member inside the pressure vessel and separating the interior volume into a water storing volume and an air storing volume;

a conduit in the pressure vessel opening and defining an air passage in communication with the air storing volume;

an air pressure switch in communication with the air passage and adapted to activate the pump in response to the air pressure in the air storing volume dropping below a first limit; and

a piercing member connected with the conduit and extending through the opening and into the air storing volume to pierce the elastic member in the event that the elastic member contacts the piercing member due to the air pressure dropping below a second limit less than the first limit.

13. The water storage apparatus of claim 12, wherein the air passage extends through the piercing member.

14. The water storage apparatus of claim 12, wherein the piercing member has an elongated needle shaped body extending away from the conduit and into the air containing volume.

15. The water storage apparatus of claim 12, wherein the piercing member is integral with the conduit.

16. The water storage apparatus of claim 15, wherein the air passage extends through the piercing member.

17. The water storage apparatus of claim 12, further comprising a seal across the opening to contain the fixed amount of air in the air storing volume in the absence of the conduit, wherein the piercing member pierces the seal as the conduit is coupled to the opening.

18. The water storage apparatus of claim 17, wherein the seal is a resilient seal.

19. The water storage apparatus of claim 12, further comprising a spud around the opening and a seal across the opening, the conduit having a threaded portion adapted to thread into the spud, the piercing member piercing the seal as the conduit is threaded into the spud.

20. The water storage apparatus of claim 19, wherein the seal is resilient to allow the conduit
5 and piercing member to be removed from the opening without sustaining substantial pressure losses in the air storing volume.

21. The water storage apparatus of claim 12, further comprising an air pressure gauge coupled to the conduit and in communication with the air passage, the air pressure gauge sensing air pressure in the air passage and providing a visual indication of pressure.

22. An apparatus connectable to a water storage tank that can selectively release water and refill with water delivered from a well via a water pump, the water storage tank having a volume of stored air, the apparatus comprising:

a conduit connectable with the tank and defining an air passage in communication with
the stored air in the tank;

an air pressure switch coupled to the conduit and in communication with the air passage,
the air pressure switch operable to activate the pump if the air pressure within the
tank drops below a first limit; and

a projection contiguous with and extending from the conduit in a direction away from the
pressure switch, the projection having an end capable of piercing a seal of the tank.

23. The apparatus of claim 22, further comprising an air pressure gauge coupled to the conduit and in communication with the air passage, the air pressure gauge senses air pressure in the air passage and provides a visual indication of pressure.

24. The apparatus of claim 22, wherein the seal is located across an opening of the tank, the seal maintains the pressure within the tank until the apparatus is connected to the tank, the projection punctures the seal as it connected to the tank.

25. The apparatus of claim 22, wherein the seal is an elastic member that separates the tank into a water storage volume and an air storage volume, the projection pierces the seal when the air storage volume loses a substantial amount of air.

26. The apparatus of claim 25, wherein the elastic member is one of a bladder or diaphragm.

27. The apparatus of claim 22, wherein the conduit comprises a threaded portion adapted to thread onto the tank, the projection positioned to pierce the seal as the conduit is threaded onto the tank.

28. The apparatus of claim 27, wherein the air passage extends through the projection.

29. The apparatus of claim 22, wherein the air passage extends through the projection.

30. The apparatus of claim 29, wherein the projection is integral with the conduit.

31. A water storage tank adapted to selectively release water and refill with water delivered from a well via a water pump, the tank comprising:

a pressure vessel having an opening and an interior volume;

an elastic member located inside the pressure vessel and separating the interior volume
5 into a water storing volume and an air storing volume; and

a seal located over the opening, the seal allowing the tank to be pressurized and remain
pressurized without additional structure closing the opening.

32. The water storage tank of claim 31, further comprising:

a conduit connectable with the tank and defining an air passage in communication with
10 the air storing volume in the tank;

an air pressure switch coupled to the conduit and in communication with the air passage,
the air pressure switch operable to activate the pump if the air pressure within the
tank drops below a first limit; and

a piercing member extending from the conduit, through the seal, and into the tank, when
15 the conduit is connected with the tank.

33. The water storage tank of claim 32, further comprising an air pressure gauge coupled to
the conduit and in communication with the air passage, the air pressure gauge senses air pressure
in the air passage and provides a visual indication of pressure.

34. The water storage tank of claim 32, wherein the pressure vessel further comprises a spud
20 around the opening and the conduit further comprises a threaded portion adapted to thread onto
the spud, the piercing member positioned to pierce the seal as the conduit is threaded onto the
spud.

35. The water storage tank of claim 34, wherein the seal is resilient to allow the conduit and
piercing member to be removed from the opening without substantial pressure losses in the air
25 storing volume.

36. The water storage tank of claim 32, wherein the air passage extends through the
projection.

37. The water storage tank of claim 31, wherein the seal is connected to the interior of the tank.

38. The water storage tank of claim 37, wherein the seal is adhered to interior of the tank.

39. A method of manufacturing a water storage tank for a well, the method comprising:
forming a pressure vessel having an opening, an interior volume, and an elastic member
located inside the pressure vessel to separate the interior volume into a water storing
volume and an air storing volume;
- 5 installing a seal over the opening, the seal capable of sealing the entire opening and
adapted to be punctured by a pressure switch mounting assembly;
pressurizing the tank with air;
preventing air from escaping the pressurized tank through the opening with the seal; and
packaging the pressurized tank for shipping while the tank is pressurized.
- 10 40. The method of claim 39, further comprising:
removing the packaging; and
attaching the pressure switch mounting assembly to the opening after the packaging has
been removed.
41. The method of claim 40, further comprising piercing the seal with a piercing member
15 coupled to the pressure switch mounting as it is attached to the opening.
42. The method of claim 39, further comprising sealing the opening with the seal prior to
pressurizing the tank.
43. The method of claim 39, wherein the tank is pressurized through a valve located in a
location other than the opening.
- 20 44. The method of claim 39, further comprising painting the pressurized tank.
45. The method of claim 39, wherein the seal is adhered to the interior of the tank.